A GEBCO Community Vision for Improving the Availability, Discoverability & Accessibility of Bathymetric Data

A Technical Action Plan for GEBCO: 2023-2030

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Introduction

The vision of GEBCO is to bring knowledge about the global seabed to the world through free and open datasets. GEBCO is uniquely positioned to champion seabed mapping activities through community coordination, capacity development, education, and collaboration. The Nippon Foundation - GEBCO Seabed 2030 project is an accelerator for advancing the global understanding of the seafloor. GEBCO and its community are positioned to substantively contribute to the UN Ocean Decade goals of ensuring that our Oceans are clean, healthy and resilient, productive, predictable, safe, accessible, inspiring and engaging.

Led by GEBCO's Technical Sub-Committee on Ocean Mapping (TSCOM), this Technical Action Plan was developed collaboratively with representation from other GEBCO Subcommittees and Seabed 2030. The foundation of this plan is technical recommendations initially generated in 2023 with broad international community input. Concepts presented in this document were further developed in 2024 during a TSCOM-led meeting that engaged leaders from all of GEBCO subcommittees and Seabed 2030 to align the technical strategic goals with GEBCO's renewed vision. This technical plan relates to the five pillars of GEBCO's renewed vision including (e.g. Data, Technologies and Standards, Capacity, Community, and Governance) and is intended to engage the subcommittees in realizing the technical goals that will benefit both GEBCO and the Seabed 2030 Initiative.

Background:

Improving the availability and accessibility of datasets that describe the global seabed requires authentic engagement of the diverse community of individuals and organizations who create, manage and utilize data for a wide variety of purposes. Input from data providers and data consumers to understand their data and metadata needs and challenges ensures the evolution of community standards, and reveals new opportunities for collaboration, coordination, and knowledge sharing. Data sharing supported by use-case-driven metadata enables equitable data discovery, access and use, and is the necessary foundation for building bespoke data and information products.

The catalyst for this work plan was the 2023 technical and scientific engagement series, co-organized by TSCOM, IHO-DCDB, and Seabed 2030, during a vision for improving the accessibility and discovery of bathymetry data was co-developed with community input (Ferrini et al., 2023). The first-of-its-kind series focused on complementary aspects of the data life cycle related to (1) Data Sharing & Archiving, (2) Data Discovery & Data Gaps, (3) Data Processing & Integration and (4) Metadata Enhancements - which can connect and fortify all aspects of data stewardship and access (Fig 1) and prioritized equitable engagement and participation to ensure that diverse perspectives were heard.

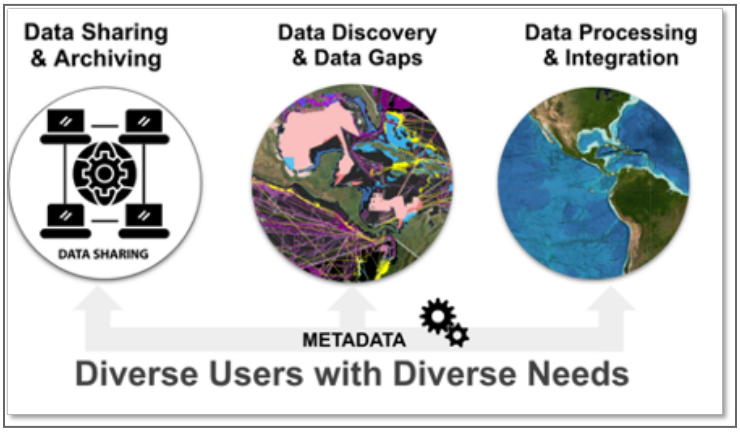

Figure 1: The complementary aspects of the bathymetry data life cycle (Ferrini, et al., 2023)

The key outcome of this engagement series was the identification of three technical priorities that would support multiple aspects of data stewardship and data discovery:

- Increasing data availability
- Enhancing metadata
- Encouraging the use of a common sonar format

Please refer to the IEEE Conference Paper (Ferrini et al., 2023) for additional details regarding the event and discussions.

A second workshop held in March 2024 (see report), honed in on these community-defined strategic goals and enabled integration with GEBCO Subcommittees to adapt and refine the technical strategic goals to align with the work of the Subcommittees and the broad vision developed by the GEBCO Guiding Committee.

Technical Strategic Goals in Support of the GEBCO Vision

Enhancing metadata, coalescing around common format standards and sharing tools and approaches for data stewardship will deliver efficiency while helping the GEBCO community grow and achieve goals that are mutually beneficial. Adopting proven practices that promote data acquisition and sharing can help deliver critical observational data that serves the common good. This action plan considers complementary perspectives across the data stewardship

continuum based on input from people within and outside of the GEBCO Community, highlighting current needs while ensuring that data practices of today are future-ready for emerging technical solutions.

Goal 1: Increase data availability: Transit mapping

This strategic priority aims to normalize opportunistic data acquisition during transits and streamline contributions to the IHO DCDB public archive. By increasing the acquisition of new data and encouraging contributions of existing data, it will expand data availability.

Historically, the sharing of survey data has been hindered by political, cultural, and technical challenges. Promoting transit mapping as a routine practice can help address these obstacles and significantly boost the amount of bathymetry data in public archives.

This goal seeks to tackle common technical and cultural challenges through a coordinated community strategy. It will highlight existing tools that support transit mapping and data submission, while emphasizing incentives for stakeholders. Showcasing success stories and sharing best practices can increase data availability at minimal cost to vessel operators and create pathways for further contributions.

Goal 2: Enhance metadata and improve web services

Web services are now a key way users discover and assess bathymetric data, but while the data may be "generally available," it is often not easily accessible. This strategic theme aims to enhance web services by defining clear steps—such as modifying data coverage web services—to improve usability and accessibility for geospatial analysis and integration.

Currently, many web services lack essential metadata, making them less useful to both casual users and those using them programmatically. Inconsistent metadata across services also hinders efficient cross-service searches. Metadata on data accessibility, sensor type, and acquisition year are often missing, but incorporating these details would significantly improve data usability.

Standardizing metadata and web services would simplify downstream integration and enable the creation of a global “Data-No-Data Layer” (DnD Layer) to show seabed mapping coverage. Presently, users must navigate multiple complex data layers for planning, which is made even harder by limited internet access during survey operations. A regularly updated DnD Layer would streamline decision-making, prevent redundant mapping, and enhance integration of multiple data layers for a more complete view of mapped regions. Improving web services is essential for achieving these goals.

Enhanced metadata that meets the needs of the GEBCO community, the Seabed 2030 Project, and all aspects of the data stewardship continuum are an important consideration of this strategic goal. Close coordination with both the GEBCO TSCOM Metadata Working Group and the Seabed 2030 Technical team is fundamental to this goal.

Goal 3: Encourage the use of a common generic sensor format for bathymetry

The Generic Sensor Format (GSF) is a sensor-agnostic format for storing swath bathymetric data, including processing flags and early-stage information like applied sound speeds. As data sharing increases, we must coordinate processing efforts to avoid duplication of effort and maximize efficiency. Sharing data in processed swath file formats allows downstream users to build on previous work without reverting to raw data. Promoting GSF adoption would improve efficiency and expand data usability across various applications.

However, current GSF users often face interoperability issues between software platforms, leading to distrust of the format. To encourage wider use, discussions with users, format developers, and software companies are needed to resolve these issues and build trust. The main goal is to create foundational documentation to address GSF interoperability problems across software packages and to encourage the adoption and use of the format.

Actions to Progress the Technical Strategic Goals in Support of the GEBCO Vision

The March 2024 working meeting included leaders of technical goals 1-3, GEBCO Subcommittees, Seabed 2030 and active TSCOM members. The key outcomes of this meeting were to review and refine the technical goals, align them with the renewed GEBCO Vision, and foster GEBCO subcommittee engagement and coordination. During that meeting, initial messaging for specific audiences based on intended outcomes was developed.

The leaders of each technical goal were tasked to develop project work plans that capture recommended actions that will help the GEBCO community achieve the goals introduced above. Please refer to the three work plans for detailed information

a) Global Bathymetric Coverage Metadata Service Project
b) Encourage Use of a Common Generic Sensor Format for Bathymetry Project
c) Encouraging the Collection of Transit Data Project

Together, these actions will strengthen and expand improvements towards the availability, discovery and access of bathymetric data in collaboration with the growing GEBCO community invested in the completion of a global map of the seafloor.

Developing a Unified Approach

Given the overlap between the three primary goals, a unified approach is a clear priority for both efficiency and impact. While the target audiences may differ, a cohesive messaging and communications strategy will ensure efficient effort and transparency among stakeholders driving each priority. The approach proposed and discussed during the 2024 working meeting is:

- Establish a coordinated communications campaign engaging GEBCO Subcommittees.
- Develop foundational technical documents for each priority.
- Develop culture change guidance documents for each priority that include vision, rationale, and tailored messaging for specific audiences.
- Develop an integrated communication campaign plan.
- Execute the unified campaign.

TSCOM looks to SCOPE, SCRUM and SCET for developing separate but integrated outreach strategic and implementation plans.

Supporting Future GEBCO

The technical strategic goals presented here are intended to support and accelerate GEBCO and Seabed 2030 in their current endeavors while also ensuring that openly shared bathymetry data and information are available for future uses including emerging technologies of cloud computing, artificial intelligence (AI) and machine learning (ML).

Envisioning GEBCO's future requires ongoing attention to evolving skill sets, shifting methodologies with respect to data acquisition and integration, and adapting to changing needs in ocean mapping and data management. Strategic planning, collaboration, and proactive efforts are critical to this strategic goal. Advancing ocean mapping and research will require a forward-looking technical strategy that fosters global cooperation, explores new funding opportunities, and addresses metadata challenges. This topic should be revisited regularly as technical activities are envisioned and pursued in support of GEBCO.

Conclusion

Improving the accessibility of global bathymetry data requires an understanding of the needs of a diverse community of individuals and organizations who create, manage and utilize data for a wide variety of purposes. An action plan for developing *A GEBCO Community Vision for Improving the Availability, Discoverability & Accessibility of Bathymetric Data* identifies needs and goals within the community and serves as a living document to better promote ongoing and future collaboration efforts. TSCOM, together with Seabed 2030, the IHO DCDB and the greater GEBCO community, will strive to support, implement and further promote the activities described above.

Acknowledgements

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